BOAT LIFT CONTROL WITH REMOVABLE BATTERY SECURITY APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention.

This invention relates to devices for the control of boat lifting apparatus, specifically to an improvement in providing convenient recharging and security for the control device by way of a novel removable rechargable battery apparatus.

Description of the Related Art

Users of watercraft have need to lift their watercraft from the water, for example for maintenance or in preparation for land transportation of the watercraft. Equally, watercraft users have need to lower their watercraft into the water, for example for launching or simply for flotation at dock. Users have heretofore employed a number of boat lift devices for such lifting and lowering of watercraft.

Mechanical operation of boat lifts may be by manual means, as taught in U.S. patent number 5,211,124 to Reiser. As described in U.S. patent number 4,482,268 to Stevenson et al., watercraft lifts alternatively may be operated by internal combustion motor. However, modern automatic boat lifts typically employ electric motors. In such lifts, electric motors may be employed directly to drive the lift, as set forth in U.S. patent 5,051,027 to Horton. Alternatively, electric motors may be employed to pump air, as in U.S. 4,072,119 to Williams, or water, as in U.S. 5,140,922 to Bowman, et al., into or out of a flotation chamber such as a pontoon for lifting the watercraft. In modern, higher capacity boat lifts, though, electric motors are most often employed to power hydraulics to provide the lifting function, such as described in U.S. patents number 5,184,914 and 5,890,835, issued to the inventor of the present invention and incorporated herein by reference.

Because power provided by a utility company may be unavailable at dockside, electric power for boat lift motors is typically provided by battery. For example, U.S.

patent number 5,281,077 to Phillips teaches an electric motor driven winch boat lift powered by battery. Bowman's '922 describes battery power to drive the electric pump for his flotation based watercraft lift. U.S. patent numbers 4,850,741 to Timmerman, 5,090,841 to Pennick, Jr. et al., and 6,554,533 to Godberson all set forth hydraulic boat lifting technology where power is supplied by battery.

After a number of duty cycles, batteries for electrically powered boat lifts of any design will require either replacement or recharging. If power is available at dockside, either from a permanent source of utility power or from a temporary source, such as a boat at dockside or an extension cord from a land-based power source, recharging of the boat lift batteries may be accomplished *in situ* from such source. However, since such power sources are not universally available at dockside, other means are more commonly employed to maintain charged boat lift batteries. Both '264 to Hey and U.S. patent number 6,543,375 to Sargent et al. teach use of solar panels for recharging. Because solar panels and the accompanying recharging hardware may add considerably to the cost of boat lift controls, however, many designs for electrically powered boat lifts instead simply assume that the batteries are to be removed and replaced with fresh or recharged batteries from time to time. Since many designs employ rather heavy 12 volt batteries, removal and replacement of such batteries can be laborious.

Because boat lifts are often located in open areas where they are left unattended for protracted periods of time, it is well known that they are often subject to unauthorized use, leading to theft and vandalism. A common practice to prevent unauthorized use of a battery operated lift is to remove the battery when the lift is not in use. Such practice, however, is laborious when heavy batteries are involved, and do not serve to thwart determined thieves who may simply provide their own battery. While the lift taught in U.S. patent number 4,954,011 to Stensen provides security by allowing removal of the entire drive assembly from the lift, such a solution is specific to lift designs providing for such removable drive assemblies and in any case is inapplicable to most hydraulic lifts.

A number of boat lift designs have attempted to address these problems with physical locks. The '268 patent to Stevenson et al. provides security for the lift by

providing a locking mechanism on the lift's safety latch. U.S. patent number 5,749,313 to Shackelford, Jr. prevents unauthorized use of the lift by pivoting the lift in raised position from over water to over land and then locking it in such position by means of a locking pin or conventional lock. All such physical locking means for providing security for boat lifts are subject to similar shortcomings: mechanical locks are subject to wear and deterioration, especially in harsh marine environments; physical locks are subject to breakage and circumvention by determined thieves or vandals, particularly in locations such as docks which are unattended for long periods of time; and, once the lock mechanism has been broken, the boat lift is generally fully operational.

What is needed is a control for electrically operated boat lifts providing an inexpensive, light-weight battery that is easy to remove, recharge and replace. What is needed further is a boat lift control that is generally applicable to electrically operated boat lifts and that affords reliable security against unauthorized use of the boat lift, thwarting would-be thieves and vandals.

BRIEF DESCRIPTION OF THE INVENTION

The present invention is a controller apparatus for electrically operated or controlled boat lifts, comprising a control unit adapted to receive and operatively engage a removable battery assembly, and a removable battery assembly unit comprising a light-weight rechargeable battery and at least some of the switches and circuitry necessary to operate the control apparatus. Without the engagement of the battery assembly unit, even if the control unit is supplied with electrical power from some other source, the controller apparatus will not operate because certain switches and circuitry necessary for operation are not present. However, when the removable battery assembly unit is operatively engaged in the control unit, the controller apparatus is supplied with power from the battery and necessary switches and circuitry are engaged with the control unit for operation of the control apparatus. In some embodiments of the present invention, the control unit further comprises a specific electronically based "lock" and the battery assembly unit further comprises a matching electronically based "key" which must cooperate with the "lock" prior to operation of the boat lift controller apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, advantages, features and characteristics of the present invention, as well as methods, operation and function of related elements of structure, and the combination of parts and economies of deployment, will become apparent upon consideration of the following description and claims with reference to the accompanying drawings, all of which form a part of this specification, wherein:

Fig. 1 is a depiction of a dockside enclosure containing a controller apparatus according to the present invention, shown in operative connection with a representative boat lift;

Fig. 2 is a depiction of a controller apparatus within an enclosure, the controller comprising a control unit and engaged removable battery assembly unit;

Fig. 3 is an exploded depiction of the controller apparatus of Fig. 2;

Fig. 4 is a functional block diagram showing functional components of the controller apparatus; and

Fig. 5 is a logic diagram with circuitry for an embodiment of an electronic lock and key between the control unit and the battery assembly unit of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention places certain components essential to operation of the lift within a battery assembly unit that is operatively engaged with the control unit. Advantageously, the battery assembly unit is removable from the control unit, affording both ease of recharge for the controller battery and security for the lift controller, which cannot be operated without the essential components removed in the battery assembly.

Turning to FIG. 1, illustrated is an exemplary boat lift operated by a boat lift control according to the present invention. The control is housed in enclosure 102, which provides protection of the control from the elements. Preferably, enclosure 102 is not only functional for such purpose, but also provides decorative utility such as provided by the enclosure described and claimed in pending U.S. design patent application serial number 29/183,762 by the inventor of the present invention, incorporated herein by reference. In the illustrated example, enclosure 102 is mounted on upright member 104 extending from a supporting leg of boat lift 110. In some other embodiments, enclosure 102 may be disposed upon an upright member affixed to or adjacent to a dock. As will be clear to those of skill in the art, the only requirements limiting the disposition of the controller enclosure in any particular embodiment are that the controller be sufficiently proximate the boat lift to permit operative engagement therewith, and that the controller be accessible for user operation.

As depicted, the controller is operatively coupled to boat lift 110 via control lines 106. In the preferred embodiment, lines 106 are hydraulic pressure lines which feed pressurized hydraulic fluid between the controller in enclosure 102 and the hydraulic ram 108 of boat lift 110. In alternative embodiments within the scope of the present invention, as will readily be appreciated by those of skill in the art, all the hydraulics of lift 110 may be external to controller enclosure 102, in which case control lines 106 are electrical control lines, operatively coupling the controller in enclosure 102 to hydraulics external to the enclosure (not shown) which are in turn coupled via hydraulic lines to hydraulic ram 108 of boat lift 110.

Turning now to FIG. 2, depicted is a controller according to the present invention within an enclosure 202 open for user access and control. The controller comprises control unit 204 operatively coupled to removable battery assembly unit 210. Control unit 204 comprises on/off switch 206 and control lines 208, preferably hydraulic pressure lines as discussed above but in alternative embodiments previously discussed, control lines may be electrical control lines or a combination thereof with hydraulic lines. Battery assembly unit 210 comprises up/down switch 212 and further contains removable battery 214, operatively coupled therewith. For ease of use, battery 214 is preferably a relatively lightweight 12 volt battery of a standard design suitable for recharging on widely available battery recharging apparatus, such as the 12V XR PACK® Extended Run Time Battery from DeWalt Industrial Tool Company of Baltimore, Maryland.

FIG. 3 depicts the controller of FIG. 2, with removable parts exploded to show means of engagement thereof. As depicted, disposed within control unit 304 is receptacle 306, designed to receive, operatively couple and removably engage mated plug 308 on battery assembly unit 310. Similarly, disposed within battery assembly unit 310 is receptacle 311, designed to receive, operatively couple and removably engage connector portion 312 of battery 314. In operation, battery 314 coupled with assembly 310 as a unit is coupled by the user with control unit 304 for controller operation. Similarly, battery 314 coupled to assembly 310 is removed as a unit from control unit 304 when the user wishes to leave the boat lift unattended. The user may then transport battery 314 with assembly 310 to a location for charging. At such location, battery 314 may be removed from assembly 310 for charging and then recoupled into assembly 310 after charging for such time as the user is to return to the boat lift. Alternative embodiments, clear to those of skill in the art, may permit charging of battery 314 while it is coupled with assembly 310.

As will be appreciated by those of skill in the art, a wide variety of means are available both for operatively coupling battery 314 to battery assembly 310, and for operatively coupling battery assembly 310 to control unit 304. Included in such means are releasable clamping matching male and female electrical connectors, as well as

matching electrical connectors used in combination with discrete releasable physical restraining means, such as engaging tooth latches, clamps and the like. As is clear to anyone skilled in the art, any means affording operative coupling combined with physically reliable, releasable connection is within the scope of the present invention.

Turning now to FIG. 4, depicted is a block diagram illustrating the functional components of the controller apparatus according to the present invention. The controller comprises battery assembly unit 402 operatively and releasably coupled with control unit 404. Operatively coupled to battery assembly unit 402 is battery 406, which, as stated earlier, is releaseable from unit 402 in preferred embodiments, but in other embodiments may be integrated with battery assembly unit 402.

Some embodiments practice electronic locking of the controller. In some such embodiments, as illustrated, when switch 408 in control unit 404 is switched to the "on" position, power is supplied from battery 406 to electronic key 410 in the battery assembly unit and electronic lock 414 in the control unit. As will be appreciated by those of skill in the art, alternative embodiments practicing electronic locking, not illustrated here but described below in reference to FIG. 5, may also comprise a powered lock 414 but have instead a passive key 410 not requiring power. In any case, for embodiments practicing electronic locking, lock 414 is operatively connected to key 410 and, when power is supplied to the lock and key arrangement, a signal 412 passes between key 410 and lock 414. If key 410 matches lock 414, then unlocked power 416 is supplied to the controller through lock 414.

Alternative embodiments may not have electronic locking. Those of skill in the art may readily construct such embodiments (not illustrated), whereby when switch 408 in control unit 404 is switched to the "on" position, power is supplied to the controller directly through switch 408.

In any case, when electrical power from battery 406 is supplied to control unit 404, power is supplied to starter solenoid 418, which in turn supplies electrical power to pump motor 420, powering hydraulic pump 424 to pressurize hydraulic fluid in the system.

Switch 426, advantageously disposed within removable battery assembly unit 402, selects between directing the lift up or down as follows. In the "up" position 428, switch 426 supplies power to "up" solenoid 430, which opens "up" valve 432, releasing fluid pressured by hydraulic pump 424 to drive hydraulic cylinder 450 in the direction needed to raise the boat lift. Similarly, in the "down" position 436, switch 426 supplies power to "down" solenoid 438, which opens "down" valve 440, releasing hydraulic fluid to drive hydraulic cylinder 450 in the direction needed to lower the boat lift. In preferred embodiments, switch 426 has a central, resting position in which power is connected neither to "up" solenoid 430 nor to "down" solenoid 438.

Battery assembly unit 402 may be removed from control unit 404 so that battery 406 may be recharged at a location distant from the controller site. When battery assembly unit 402 is removed from control unit 404, the necessary switching to operate valves 432 and 440 through solenoids 430 and 438 is also removed from the control unit, thereby providing extra security against unauthorized operation of the boat lift.

Turning now to locking means, employed in some embodiments of the present invention, FIG. 5 depicts an electronic lock and key arrangement that may be advantageously employed. DIP switches 502 disposed within the control unit are configured to match conductor block 504 of electronic key 506 disposed within the battery assembly unit of the present invention. The key depicted in FIG.5 is four bits in size. For each such bit *a*, *b*, *c* and *d*, a conductor in block 504 is either open or closed and a switch is appropriately set in DIP switches 502.

When the battery assembly unit is engaged with the control unit, as described above, connector 508 (such as a DB-9 or other appropriately chosen electronic connector) in the battery assembly unit is mated to connector 510 in the control unit. Positive voltage is supplied to the lock in the control unit via mated connectors 508 and 510. Positive voltage is also supplied to one side of conductor block 504. Depending on whether the corresponding portion of conductor block 504 is open or closed, each of lines *a*, *b*, *c* and *d* will have either positive voltage (if block 504 is closed for that line) or no voltage (if block 504 is open for that line).

Corresponding to lines *a*, *b*, *c* and *d* from conductor block 504, switches 502 will each be either in position 1 or position 2. For a given line, position 1 corresponds to conductor block 504 closed for that line. When the switch 502 for the line is in position 1, the voltage for that line from key 506 is transmitted through connectors 508, 510 through switch 502 to corresponding converter (YES gate) 512. If no voltage is present on the line, gate 512 outputs a logical "0", while if voltage is present on the line gate 512 outputs a logical "1". Output from converter 512 is input to AND gate 514.

In addition, when the switch for the line is in position 1, corresponding line 516 is open and no voltage is transmitted on that line to converter 518.

For a given line, position 2 in switch 502 is to correspond to conductor block 504 open for that line. When the switch 502 for that line is in position 2, corresponding line 516 to converter 518 is connected to the corresponding signal on that line from key 506 in the battery assembly unit. If there is voltage on any line 516, the output of converter 518 will be a logical "1". Furthermore, when switch 502 for a given line is in position 1, positive voltage is supplied to corresponding converter 512 and so logical "1" is supplied to corresponding AND gate 514.

Inverter 520 inverts the signal from converter 518. As will be clear to those of skill in the art, the output of inverter 520 will be logical "1" unless a switch for at least one line is in position 2 and there is positive voltage on that line because the corresponding portion of conductor block 504 is closed. As will also be clear to those of skill in the art, the output of cascaded AND gates 514 will be logical "1" unless a switch for a line is in position 1 and there is no voltage on that line because the corresponding portion of conductor block 504 is open. The output from inverter 520 and from cascaded AND gates 514 is input to AND gate 522. If and only if the output from gate 522 is logical "1", relay 524 is closed to provide positive voltage to control unit circuitry. The relationship between the status of conductor block 504, the setting for switch 502, input and output of inverter 520, output of cascaded AND gates 514 and output of AND gate 522 is summarized in Table 1, with logical "0" represented by "F" and logical "1" represented by "T".

Conductor block 504	Switch 502 position	Inverter 520 in	Inverter 520 out	AND gate 514 out	AND gate 522 out
Open	1	F	T	F	F
Open	2	F	T	T	T
Closed	1	F	T	T	T
Closed	2	T	F	T	F

Table 1

As will be evident to those of skill in the art, the output of AND gate 522 is true if and only if switch 502 is in position 1 and conductor block 504 is open, or switch 502 is in position 2 and conductor block 504 is closed. In this manner, power is supplied to the control unit when the battery assembly unit is engaged, only when the settings of switch 502 in the control unit exactly match the settings of the conductor block 504 in the battery assembly unit. Accordingly, a given control unit may be configured to match only a specifically keyed battery assembly unit.

While the foregoing example depicts a key of only four bits in size, it will be clear to those of skill in the art that the present invention is not so limited and that the apparatus may be scaled to accommodate a key of any size.

As will also be appreciated by those of skill in the art, depicted is only one form of electronic lock and key arrangement between the control unit and the battery assembly unit. Embodiments of the present invention employing lock and key arrangements, however, are not limited to any particular form of electronic lock and key means and, in fact, any such means known to those of skill in the art may be employed and are intended to be within the invention's scope. Without limitation, such means include other forms of electronic lock and key arrangements, such as microprocessor control that may involve challenge and password interaction, for example, or more complex negotiations between lock and key that are algorithmically rather than password driven.

Furthermore, connection between key and lock need not be electrical. For example, control unit lock may employ a receiving device and battery assembly unit key may employ a transmitter or transponder device for radio frequency identification

employing technology such as TI-RFID or TIRIS from Texas Instruments Incorporated of Dallas, Texas. In other embodiments, more complex wireless protocols, such as Bluetooth or IEEE 802.11 may be used for communications between lock and key. In yet other embodiments, control unit lock may comprise a bar code scanner with processor and memory and battery assembly key may simply comprise a bar code matching code stored in memory in the control unit lock. In yet embodiments, battery assembly key and control unit lock may communicate via visible or infrared LED transmission. In yet other embodiments, the lock and key arrangement may be strictly physical, relying upon a mechanical lock in the control unit that is unlocked by an engaging matching mechanical key in the battery assembly unit to enable power to the control unit.

CONCLUSIONS, RAMIFICATIONS, AND SCOPE

Accordingly, it can be seen that the invention described herein, by providing a boat lift controller comprising a control unit adapted to receive and operatively engage a removable battery assembly, and a removable battery assembly unit comprising a light-weight rechargeable battery and at least some of the switches and circuitry necessary to operate the control apparatus, affords the boat lift user with enhanced convenience and security. Because the light-weight battery assembly is designed to be removed from the controller, convenient recharging of the controller battery power source is facilitated, without the need for expensive utility power or photovoltaic power supplies at the controller. Furthermore, because components necessary for boat lift operation are removed from the controller when the battery assembly is removed, the boat lift cannot be operated without the battery assembly, thereby enhancing the security of the unattended boat lift.

Although the detailed descriptions above contain many specifics, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. Various other embodiments and ramifications are possible within its scope, a number of which are discussed in general terms above.

While the invention has been described with a certain degree of particularity, it should be recognized that elements thereof may be altered by persons skilled in the art without departing from the spirit and scope of the invention. Accordingly, the present invention is not intended to be limited to the specific forms set forth herein, but on the contrary, it is intended to cover such alternatives, modifications and equivalents as can be reasonably included within the scope of the invention. The invention is limited only by the following claims and their equivalents.